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AN HISTORICAL PERSPECTIVE

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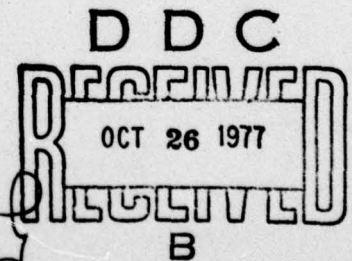
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evaluation of the overall methodology and some concluding remarks about the Depot Maintenance Planning and Programming System.

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Abstract

This report presents the chronological development of the Depot Maintenance Planning and Programming System by the Naval Sea Systems Command. It traces the DOD requirements for the System, and examines the evolution of approaches considered by NAVSEA to meet those requirements.

These approaches involved the level of detail at which data must be gathered and maintained in order to make depot maintenance projections. Specifically, the manner in which repair and alteration projection methodologies were developed are explored in great detail. Also given is an evaluation of the overall methodology and some concluding remarks about the Depot Maintenance Planning and Programming System.

1.0 Introduction

1.1 Background

This report documents the evolution of the approach taken by the Naval Sea Systems Command (NAVSEA), Code 071, in the first two and one half years of the development of the Depot Maintenance Planning and Programming System (DMPPS). The DMPPS consists of two major elements:

- i) the mechanized projection of U.S. Navy ships equipment for depot maintenance and depot maintenance support,
- ii) a continuous feedback system to insure the currentness and validity of the projections.

The basis of the requirement for the System was initially established by DOD Instruction 4151.15 of 24 June 1969 wherein the need to generate the following outputs was specified:

- i) Five year projections of total depot maintenance direct manday workload requirements and labor and material^{*} costs for each individual hull^{**} by workload breakdown structure.
- ii) Stratification of the above by
 - a. mission essential, non mission essential
 - b. organic, interservice, contract.

* Only the incidental material funded by Operations and Maintenance Navy and Navy Reserve (O&MN and O&MNR) appropriations is to be projected. Material purchased within Other Procurement and Weapon Procurement Navy (OPN and WPN) is excluded.

** The unscheduled and other shipwork which is performed may be assigned a generic name and hence need not be identified to a unique hull.

iii) Five year projections of depot maintenance direct manday workload requirements for each individual hull in Naval shipyards by production shop category.

iv) Five year projections of industrial plant equipment and facility space for Naval shipyards by individual hull to be supported.

v) Five year projections of employment in Naval shipyards by production shop category and by individual hull to be supported.

The workload breakdown structure put forth in the 1969 instruction was:

Hull appendages

Propulsion plant, machinery and boilers

Auxiliary, mechanical and piping systems

Ordnance, fire control, mechanical, electrical and electronic systems

Electrical ship service systems and components

Electronic, navigational and communication ship service systems

Ship habitability, furnishing and preservation

Ship support services and ship movement support

General shop support

Ship support facilities and equipment

The requisite production shop categories were:

Hull superstructure and appendages

Propulsion plant machinery and boilers

Auxiliary, mechanical and piping

Ordnance and fire control

Electrical

Electronic, navigational and communication

Habitability, furnishing and preservative

No serious attempt was made to implement the instruction however - the major drawback being the alignment of the production shop categories with the workload breakdown structure. In the other services, especially the Air Force, there is an agreement between the two. In the Navy however, shipyards are organized around already existing production shop categories very much different from those in the instruction.

In September 1973 an Ad Hoc Group Conference was sponsored by OSD (I&L) to study the difficulties in implementing the 1969 Instruction. It was agreed that NAVSEA would review the ship production shop categories and workload breakdown structure to develop a more suitable framework. Accordingly, in October 1973, NAVSEA recommended:

- i) the adoption of ship work breakdown structure (SWBS) as defined in MIL-STD-881 instead of the workload breakdown structure,
- ii) the substitution of actual Naval shipyard production shop categories for the ones previously promulgated.

The SWBS breakdown is:

Hull Structure

Propulsion Plant

Electrical Plant

Command and Surveillance

Auxiliary Systems

Outfit and Furnishings

Armament

Direct Maintenance Support

Ship Support Services

The actual production shop categories are:

Central Tool

Shipfitter

Sheetmetal

Forge

Welding

Inside Machine

Weapons Systems

Marine Machine

Boiler

Electric

Pipe and Copper

Woodworking

Module Repair and Maintenance *

Electronics

Paint

Rigging

* This was neither recommended nor incorporated into the Instruction, but was however maintained within the DMPPS at the request of NAVSEA 07121.

Foundary
Patternmaking
Temporary Services
Other

A revised draft DOD Instruction 4151.15 was issued 9 September 1974 which incorporated the above recommendations along with several other changes. Even though a year was to pass prior to the actual issuance, NAVSEA was aware of the changes which would be forthcoming and hence proceeded with the implementation of the System. Hence the requirements of the revised instruction are presented here, out of chronological order, in order to put the development of the DMPPS methodology into context.

The specified outputs of the revised instruction were:

- i) Five year projections of labor and material costs for each individual hull by SWBS,
- ii) Stratification of the above by
 - a. mission essential, non mission essential
 - b. organic, interservice
 - c. active fleet, reserve fleet, military assistance program,
- iii) Five year projection of depot maintenance direct manday workload requirements for each individual hull in Naval shipyards by actual production shop category and SWBS^{*},
- iv) Five year projections of industrial plant equipment and facility space for Naval shipyards
- v) Five year projections of employment in Naval shipyards

* This was not explicitly stated but assumed to be the case.

The most significant differences were:

- i) Elimination of industrial plant equipment, facility space and employment projections by individual hull to be supported,
- ii) Elimination of employment projections by production shop category,
- iii) Replacement of the workload breakdown structure with SWBS,
- iv) Extension of workload projections to include both SWBS and production shops; i.e., matrix form,
- v) Replacement of the old production shop categories with those that already existed in the shipyards.

The remainder of this report examines in varying degrees of detail, the methodology for generating the requisite outputs in a mechanized manner and the development of the feedback system to update the bases of the projections.

1.2 Basic Approach

In November 1973, NAVSEA initiated active attempts to implement the revised DOD Instruction 4151.15 as the DMPPS. David W. Taylor Naval Ship Research and Development (DTNSRDC) personnel were contracted to perform the work. By January 1974, a basic implementation approach was determined. This overall approach, as described in the rest of this section, remained constant over the entire System development.

The basic driver or input to the DMPPS would be the NAVSEA Long Range Planning System (LRPS) generated overhaul schedule. By considering the Program Objective Memorandum overhaul schedule, overhaul cycles, nuclear refueling requirements, shipyard capabilities, shipyard specializations, homeport policy, priority of work, Navy/private split, etc. a ten year overhaul schedule is produced. The overhaul schedule contains a unique shipyard assignment for every availability and specifies the number of mandays required and the type of work to be done.

In order to make the five year projections of depot maintenance direct manday workload requirements by production shop category and SWBS, distinct projection matrices had to be developed for each LRPS availability within the five year projection period. The projection matrices are ones in which the ij^{th} entry represents the fraction of work done in production shop category j, SWBS i, for its corresponding availability. The procedure to be used by the DMPPS is to multiply, in the mathematical sense, a projection matrix by the mandays of its corresponding LRPS availability to form a workload projection matrix.

The Naval shipyard portion of the above matrices satisfies the requirement to project workload by individual hull at the Naval shipyards. If the elements of the total set of the above matrices were multiplied by the appropriate manday rates and incidental material costs were added, then the requisite cost projections by SWBS could be made. Additionally if the LRPS type of work were associated with each of the workload matrices, stratification by mission essential/non mission essential, organic/interservice, and active/reserve/military assistance could be achieved.

Finally, the remainder of the required outputs already existed as part of the LRPS and the Shipyard Modernization System (SMS) which uses the LRPS overhaul schedule. The LRPS itself generates shipyard employment projections for each of the ten years it considers. The SMS produces industrial plant equipment and facility space projections over the same period.

Thus the development of the DMPPS was reduced to the development of projection matrices for the LRPS availabilities. There are many related topics which were considered in implementing the System. These topics will be listed here for completeness, but not described any further in this document:

- the use of functional shops
- considerations of covered shop space
- direct mandays versus production shop productive
- techniques for conversion of mandays to dollars
- factors for determining incidental material costs
- projection for unscheduled and other shipwork
- details of the LRPS and the SMS

2.0 First Attempts at Matrix Development

2.1 Investigation of Air Force System

In February 1974 a trip was made to the Air Force Logistics Command (AFLC) at Wright-Patterson Air Force Base, Fairborn, Ohio. The purpose of the trip was to determine what the Air Force had done and was planning to do in conjunction with DOD Instruction 4151.15, and to see if any of their work was applicable to NAVSEA.

The system, implemented by the Air Force, relied heavily on the use of their supply data. For each federal stock number (FSN) in the supply system, Air Force planners in their field organization had allocated expected manhours and labor and material costs. This information was computerized and accumulated at headquarters. To implement depot maintenance forecasting, a method was developed to associate all FSN's to aircraft model, designation, and series and to work breakdown structure. Thus reports could be produced by sorting and extracting appropriate data. Since the Navy supply data was not associated with any workload measures, nothing in the Air Force methodology was suitable for use by NAVSEA.

2.2 Request for Shipyard Development

In March 1974 trips to Long Beach and Puget Sound Naval Shipyards were made in order to:

- i) determine the extent that SWBS was being used in the preparation of shipwork job order numbers
- ii) explore means by which preliminary projection matrices could be developed in a short time frame
- iii) develop plans for update, refinement, and validation of data.

Specifically NAVSEA intended to task shipyard planning departments to estimate matrices by ship class. Such matrices would be used until such time as data could be extracted from the shipyard management information system (MIS) to replace the estimates with averages of actual work. This of course assumed that SWBS and shop data was available within the MIS in a consistent fashion.

Long Beach Naval Shipyard was visited first. Long Beach was unwilling to supply the inhouse effort required to estimate matrix entries, however they did indicate that such data could be extracted from the shipyard MIS. All work done on major ship availabilities is recorded on shipyard employee time cards against a ten-digit job order number. The first five digits of the job order number are termed the customer order accounting record (COAR). The first two digits of the COAR are called the work category and generally indicate the type of work performed. The remaining three digits of the COAR are the availability number which identifies the ship on which the work is done.

The three digits following the COAR in the job order number identify the three-digit SWBS* element of the work. Finally the last two digits contain a sequence number. Also, associated with each job order number, is the shipyard cost center in which the work was performed. All of the actual shipyard production shop categories have a single, unique cost center with the exception of Module Repair and Maintenance which is composed of two cost centers and Other which consists of all others.

All of the above data is contained within the shipyard MIS. Additionally, manhour estimates as well as expenditures are also available. Long Beach Naval Shipyard agreed to accept funding from NAVSEA to develop a computer program which would extract requested information from the shipyard MIS. For every COAR in the MIS, cumulative estimated and expended manhours and total dollars would be extracted at the one-digit SWBS level for every cost center for which there is data. The computer program would be sent to all Naval shipyards by Long Beach, with installation instructions - the MIS being common to all shipyards. Each shipyard would run the program at the close of the accounting month and send the output on a magnetic tape to NSRDC for further processing. The processing would consist of in part, the formation of the actual SWBS/shop matrices for completed availabilities. These matrices would then be used to develop formal projection matrices in lieu of the shipyard planners making estimates.

* SWBS is a three digit structure. The categories mentioned in reference to DOD Instruction 4151.15 correspond to the first digit of the three digit code, hereafter referred to as the one-digit SWBS level.

Thus, the purpose of the trip to Puget Sound from Long Beach was modified to verify that the Long Beach computer program would be effective. Equivalently, the Puget Sound job order number structure was to be examined to verify that it was in agreement with that of Long Beach (the official way that it should be done). It turned out that Puget Sound was the only shipyard which was not using the standard MIS. Implementation was scheduled for July 1974. Thus no data for ships that were underway or for which planning had begun would be obtainable since SWBS was not part of the planned job order numbers. Thus Puget Sound would not be able to supply any useful data for some time, although the SWBS structure would be used properly for all future work.

2.3 Initial Matrix Report Generation

The problem with using the Long Beach proposed extraction method was that only current work would be on the MIS files. When a ship is completed, all information is permanently purged from the files. There is no other source of historical SWBS and shop data. Hence a considerable amount of time would elapse before enough completed ship data was obtained to provide a sufficient data base. It was hoped that manhour estimates would be usable so that preliminary matrices could be developed prior to availability completion. In fact however, estimates did not compare favorably with final expenditures, and consequently were not used.

Thus in order to provide a prototype deliverable for OSD by July 1974, a methodology using the existing LRPS Trade Level Forecasting System was devised. Some attempts were made to actually implement the prototype, but in general no serious effort was made.

3.0 Revision of Single Matrix Philosophy

3.1 Results of Shipyard Data Tape Analyses

Prior to the actual receipt of MIS data from the Naval shipyards, NAVSEA expected the basic structure of the DMPPS to be fairly well defined. Over a period of time, a projection data base should be developed. Computer programs to extract projection data from the tapes and use LRPS outputs to generate reports had been preliminarily defined. The shipyard data submissions would form the nucleus of a continuous feedback system. However analyses of the shipyard data first received in September 1974, showed that modifications to the perceived projection methodology had to be made.

Some quality problems did occur, but they were not of a very serious nature. As was previously mentioned, Puget Sound data was unusable. A similar situation existed in Mare Island. For nuclear submarine work, ship system index (SSI) was used instead of SWBS. An approximate conversion scheme was developed for these cases. Charleston Naval Shipyard used Industrial Priority Numbers (IPN) instead of SWBS for all work. Since IPN is very similar to SSI, the same conversion factors were utilized.

By far the most important observation made from the data was the distinction between alterations and repairs. Through the use of the work category, availabilities could be easily separated into their alteration and repair parts. By individually comparing alteration and repair percentages between similar ships, it became immediately obvious that a single matrix for an availability could only be accurately developed as the weighted sum of alteration and repair projection matrices.

Repairs packages did appear to be similar within ship classes but this was not the case for alterations which average approximately 50% of the work performed on regular ship overhauls. Since an alteration only occurs once to a given ship, subsequent ship overhauls will have an entirely different alteration package. There is no reason to expect a similar SWBS or shop breakdown. Thus using historical alteration data will in general lead to poor projections.

Hence a revised approach to the development of the DMPPS was established. This approach was followed until May 1975 when a major shift in emphasis and level of detail occurred. The basic element of the approach was to develop a data base of separate alteration and repair projection matrices for each LRPS availability.

Matrix selection criteria was on the basis of:

- i) ship type
- ii) hull number
- iii) sequence number *
- iv) type of work

The LRPS was modified to include the alteration percentage of the availability which would be used as a weighting factor in adding alteration and repair matrices. Repair matrices were to be developed from historical averages. The approach to alteration matrix development was to undergo several changes. These will be detailed in Section 4.0.

* The sequence number for an availability indicates which one it is in the life of the ship.

3.2 Evaluation of New Philosophy

Within DOD Instruction 4151.15, a myriad of purposes for the DMPPS were stated. Some of the more important of them are as follows:

- i) Align the support establishment with end item and operating forces in terms of facilities, industrial plant equipment, and workforce.
- ii) Measure projected against actual workload.
- iii) Evaluate the effect of budget constraints on workload.
- iv) Examine the extent of duplication within DOD.
- v) Examine the extent of interservicing within DOD.
- vi) Determine the extent to which ship systems (via SWBS) absorb maintenance resources.

The major difficulty in implementing the DMPPS was the explicit consideration of alterations. The task of developing alteration matrices caused extreme and unnecessary complications in the System development. No accurate methodology for their development was ever determined. * This eventually led to the creation of a parallel, simple system which, at the time of this report, appears to be replacing the more complicated one. According to the purposes enumerated above, there was no obvious need for NAVSEA 071 to become so deeply involved in the alteration program.

* The following sections will explain the evolution of approaches.

The first three purposes were designed to force NAVSEA to more effectively manage ship maintenance. Each of these objectives, however, were already being met within NAVSEA 07. The Shipyard Modernization System was (and still is) an effective and widely recognized tool for projecting facility and plant equipment requirements as well as skilled trade level imbalances. The LRPS was used to project shipyard employment in the Program Objectives Memorandum. Actual workload was compared on a quarterly basis to LRPS projections. In addition, normal application of the LRPS programs were made to evaluate the effect of various scheduling alternatives resulting from budget fluctuations and other special circumstances. The DMPPS in no way affected any of the above operations.

The fourth and fifth stated purposes are concerned with programs that DOD wanted to monitor. However concurrently with DOD Instruction 4151.15, OSD(C) initiated the implementation of a Depot Maintenance Cost Accounting System which would more effectively serve these purposes. Only in the last of the stated purposes was SWBS necessary.

Here DOD was attempting to monitor those ship systems requiring the most support. Such an endeavor was definitely needed. Ship support costs had been rising very rapidly over the years and some means of determining where maintenance money was being spent^{*} was necessary. Identification of a SWBS breakdown for alterations

* This DMPPS is only a partial solution since intermediate and organizational maintenance costs were overlooked.

does nothing in this regard however. Alterations usually are made to improve the military capability of the ship. They will of course have an effect on maintenance, but it is certainly erroneous to consider them simultaneously with repairs. **

It is true that there were (and still are) serious problems with the alteration program. Although the program was, on paper, managed by NAVSEA, OPNAV exercised total control. Thus NAVSEA information was extremely unstable in that OPNAV would frequently and radically change alteration schedules and priorities. In addition, there was no way of associating OPN and WPN material procurement costs with alteration installation dollars. Thus large amounts of unmonitable monies were being ignored.

NAVSEA 071, irregardless of all the problems and the purposes for which alteration data was needed, attempted to make accurate projections. By submitting projections to OSD, NAVSEA 071 hoped that improvements would be made in alteration planning. In fact, NAVSEA 071 became so hopelessly immersed in the alteration program difficulties, that no satisfactory projection methodology was ever developed.

If OSD did want to force better planning in the alteration program, the DMPPS was not the proper mechanism to accomplish this. Detailed alteration SWBS and shop projections were not necessary to meet the DOD Instruction 4151.15 objectives and purposes. Any attempts to discipline alteration planning should have been made at the sources- OP 43 and the fleets.

** Only for shops is it important to consider alterations with repairs and this was being satisfactorily handled by the SMS.

4.0 Initial Repair and Alteration Matrix Development

Although considerable variation in alteration packages had been observed, the repair parts of overhauls appeared more stable. Repair matrices from regular overhauls were to be generated from the shipyard data tapes. Within ship classes, these matrices would be averaged to form the projection matrix. Where no data was available, the projection matrix from the most similar ship class would be used.

As was previously stated historical averages of ship alterations will generally lead to poor projections. The Ship Alteration Management Information System (SAMIS) is the official source for programmed alterations for each Navy ship. The second approach for generating alteration projection matrices was to request that the appropriate information be incorporated within SAMIS or obtained from SAMIS managers. The following information would be needed:

- i) SWBS for each alteration
- ii) Installation mandays for each alteration
- iii) The shop spread (i.e., the fraction of the alteration installation mandays for each shipyard production shop) for each alterations.

Then an alteration matrix for a given ship could be constructed as follows:

- i) Multiply each alteration shop spread by its corresponding mandays.
- ii) Insert and sum each of the above determined manday spreads into a matrix.

iii) Divide the resulting matrix by the sum of the installation mandays.

Shop data was unfortunately unavailable at NAVSEA, and hence SAMIS managers refused the NAVSEA 071 request as being infeasible. Thus the approach needed further revision.

The modified approach consisted of obtaining the total mandays and one-digit SWBS for every alteration in a given availability. This information would be summed to form a manday vector at the one-digit SWBS level. Historical trends by one-digit SWBS would be used to allocate these mandays to the production shops. Manday and SWBS data could be obtained from SAMIS since data elements already existed for them. A discipline would have to be established for maintaining these fields.

Problems were also encountered with this modified approach: there was no satisfactory source for the historical information to be used to spread the manday data to production shops at the one-digit SWBS level. Historical repair data bore no relationship to historical alterations data, i.e., the shop spread for repairing was not similar to the shop spread for replacing. There was better correlation between different alterations at the one-digit SWBS level, but not good enough for use in making projections.

By considering many ships, average shop spreads were obtained. These averages did show some trends in certain shops, but in general, the distribution was flat. Given the amount of work required to generate these averages which were only approximate, this approach was also abandoned.

The next attempt at developing an alteration projection matrix involved the concept of an average alteration package. If all ships within a class would receive the same or approximately the same set of alterations, then a historical approach would be satisfactory. Unfortunately however, it was determined that not only was there no basic alteration package, but also no stability in the planned alterations was perceivable.

Thus, almost in desperation, an extremely cumbersome approach was planned. SAMIS would be used to obtain a list of alterations per availability and the mandays and SWBS for each alteration. Data to spread the alterations to the shops would be collected and maintained by NAVSEA 071 from shipyard actual performances and from pre-performance estimates when actual data was unavailable. The major drawback to this approach was the quantity of the data that would have to be maintained. At least 10,000 different alterations are performed every five years. NAVSEA 071 would have to monitor each of these alterations - truly an enormous task.

5.0 Finalized Repair and Alteration Matrix Approach

As a result of studies performed by Ernest W. Murr (Mantech of New Jersey Corp.) in May and November 1975, a major shift in the methodology for the development of matrices was made. The key element in this new methodology was the consideration of SWBS at a three-digit level.

Previous attempts to characterize the shop spread of alterations by single-digit SWBS proved unsatisfactory. In the repair case, only rough shop spreads were obtainable at the one-digit level. However shop spreads, especially for repairs were concluded to be much more reliable at the three-digit SWBS level. In other words, the distribution of mandays to production shop categories could be accurately predicted for a given three-digit SWBS element.

It was also concluded and verified by Mr. Murr that it was not necessary to consider each SWBS element individually. Unique groupings of SWBS elements were determined which had similar shop spreads. These groupings were termed depot maintenance planning modules (DMPM). Seventy nine such DMPM's were identified and then became the basis of the development of repair matrices as described below.

SWBS repair profiles were developed from studies of shipyard departure and FA-923A reports. A SWBS repair profile consists of the fraction of work by three-digit SWBS element for the availability under consideration. The SWBS repair profiles were then consolidated by DMPM to form DMPM repair profiles. These DMPM repair profiles were then combined by ship class and type of work to form average DMPM repair profiles.

Long Beach Naval Shipyard developed a prototype computer program to extract shop data at the three-digit SWBS level. This program was installed at Norfolk and Long Beach Naval Shipyards to extract average shop spreads (termed shop vectors) for each of the DMPM's. Separate sets of shop vectors were developed for carriers, other surface ships, and submarines. With this information, the DMPPS could be executed for repair projections.

For each DMPM repair profile, the fraction of work for each DMPM would be spread to the production shop categories by the appropriate shop vectors, hence forming a DMPM/shop projection matrix. This DMPM/shop matrix was then combined into the familiar SWBS/shop repair projection matrix. Such a matrix would be developed for each LRPS availability and then multiplied by the corresponding repair mandays to yield DMPPS repair projections.

The DMPM shop vectors were applied to alterations as well as repairs. For small alterations, below 750 installation mandays, the DMPM shop vectors were used instead of detailed alteration estimates. Small alterations were considered by Mr. Murr to be equivalent to repairs in terms of shop spreads. Larger alterations would still require estimates, however the number of these alterations was approximately 1000-far fewer than the total number of ship alterations that previously were to be considered.

The approach to the development of alteration matrices would thus be as described in section 4.0. The alterations corresponding to each LRPS availability would be extracted from SAMIS along with their SWBS and installation mandays. If the installation

mandays were less than 750, the appropriate DMPM shop vector would be used to spread the mandays to the production shops. For large alterations an individual estimate would be used for shop data. If no scope were available, DMPM shop vectors would also be used in these cases. The result would be a DMPM/shop alteration manday matrix. This matrix would be converted to the one-digit SWBS level and divided by total SAMIS mandays to yield the DMPPS alteration projection matrix.

One more ingredient was however required to complete the alteration projection matrices. Ordnance, special project, and nuclear alterations were not in SAMIS. Procedures to incorporate their mandays as separate inputs into the DMPPS were also developed but never fully implemented. DMPM shop vectors were sufficient in all of the above cases to spread these mandays to the shops.

The final element of the DMPPS was the continuous feedback system to update projection factors. The prototype three-digit SWBS extraction program developed by Long Beach would be installed in all shipyards. Instead of sending the data types monthly, however, the shipyards would forward them on a quarterly basis and the tapes would contain only information concerning completed availabilities. Thus a complete plan for the DMPPS was established and was ultimately implemented with very few modifications.

6.0 Concluding Remarks

Even after the development of the finalized methodology certain problems still existed. Most of these involved the alteration program.

- i) SWBS was incomplete in SAMIS. VITRO Laboratories were funded to add SWBS to SAMIS for existing alterations and a nearly complete job was done. SWBS were still lacking in cases where the description of the alteration was unavailable. However the SWBS data element was not maintained for new alterations. NAVSEA Ship Logistics Managers (SLM's) refused to have anything to do with the program since it was unimportant to their function, SAMIS managers did not have enough staff to provide any assistance.
- ii) SAMIS mandays were unreliable. These estimates were generally provided by SLM's, however there was no incentive for them to do a good job. It is necessary to get alterations put into SAMIS for advance ordering of material. The mandays are unimportant. The shipyard estimates the mandays actually required. Dollars show expected costs. Hence there was no control mechanism to validate the manday data element.
- iii) There was a large instability in alteration packages. Substantial changes were always occurring. This was primarily due to Navy crisis management. As a program obtained high level attention, its alterations received high

priority. The Fleets and OPNAV used SAMIS as a ledger so that OPN/WPN material could be purchased. SAMIS data thus did not necessarily bear any resemblance to the most likely program. This was especially true in the outyears where no firm planning could be made at all. Especially at the time when the Navy produces the POM, SAMIS is used only as a mechanism to print OPNAV decisions. This usually entails an entire revision of SAMIS contents to reflect a series of massive changes that have just taken place.

- iv) Shipyard estimates were not available for large alterations. Detailed shop estimates were made on few alterations more than three or four months prior to their first occurrence. Hence as a projection tool, estimates would not be helpful since they would not be available until after the projection is made.
- v) Shop projections produced by the DMPPS were inherently different from those projections already being made by the SMS. The reason of course was the different data bases being used. Since SMS projections were accepted by higher authority in justifying shipyard modernization requirements, a lack of consistency between the two systems would only serve to confuse and weaken NAVSEA requests for resources for shipyard modernization.

Because of these problems, NAVSEA decided to develop another system, the Depot Maintenance SWBS System (DMSS), whose projections were based on data aggregated on a higher level. As the name implies, the DMSS generates reports by SWBS only. The SMS was adapted for use by NAVSEA in generating reports by shops.

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